CHEMICALS

Project Fact Sheet

Supercritical Purification of Compounds Used for Combinatorial Chemical Analyses

Innovative Method of Purifying Combinatorial Chemistry Compounds Reduces Energy Use and Chemical Waste of Processed Chemicals

Benefits

- Requires just 2 percent of the energy required by the LC system per purified compound, offering potential industry-wide energy savings of 590 megawatt hours per year
- Reduces liquid chemical waste by 95 percent per purified compound, potentially avoiding approximately 4 million gallons of waste industry-wide per year by eliminating the generation of chlorinated organic and mixed aqueous/organic waste
- Reduces processing time and increases the number of compounds that can be processed, while producing a purity of 95 percent or greater

Applications

The new technology is applicable to those companies undertaking process science and engineering technology for the chemical industry, particularly drug discovery companies that currently use LC technology.

Project Partners

NICE³ Program
Washington, DC

Delaware Economic Development Office
Wilmington, DE

Berger Instruments
Newark, DE

Agouron Pharmaceuticals, Inc.
La Jolla, CA

AstraZeneca
Wilmington, DE

Berger Instruments, the Delaware Economic Development Office, and two other industrial partners, Agouron Pharmaceuticals and AstraZeneca, are commercializing a preparative-scale Supercritical Fluid Chromatograph (SFC). This innovative approach to combinatorial chemistry analyzes samples approximately 20 to 100 times faster than current prep-scale Liquid Chromatography (LC), greatly reducing waste and energy use.

Conventional prep-LC systems are capable of purifying only five to ten compounds per day using an acetonitrile-in-water mobile phase. With the wide variation in number of complex chemical compounds that need to be tested, this process requires several manual operations, two to three trial runs, and up to 48 hours to remove the acetonitrile and water from the purified product. This time-consuming work poses a bottleneck for drug discovery groups that depend on purity. This new SFC technology provides a solute purity of 95 percent or greater, and very rapid fraction collection that approaches full automation without manual intervention. The system separates compounds that are soluble in supercritical CO_2.

Supercritical Fluid Chromatograph

SFC technology uses CO_2 to achieve greater processing speed and separation of pharmaceutical compounds compared to traditional LC separation. This new type of purification improves product quality and energy efficiency, while reducing waste, processing time, and costs.

Project Description

Goal: Commercialize an innovative preparative-scale Supercritical Fluid Chromatograph (SFC) that purifies combinatorial chemistry compound libraries at 20 to 100 times the rate of current preparative-scale Liquid Chromatography (LC) systems. This packed column system will be targeted toward LC operations where SFC could offer major speed and resolution advantages, and where energy efficiency and chemical waste reduction will be optimal.

Time-consuming purification is diminished with SFC, a very rapid separation and fraction collection approach that lends itself to eventual full automation. SFC is a packed column analysis system technique similar to LC, but using compressed fluids such as CO_2 rather than liquid solvents as the primary component of the mobile phase. The high diffusivity and low viscosity of CO_2 results in greater speed and resolution than possible with LC.

This SFC purification system addresses one of the greatest bottlenecks in the pharmaceutical drug-discovery field. It makes it economically feasible for a pharmaceutical company to purify 100 to 200 compounds per day per machine, in contrast to the current manual method in which a chemist can only purify five to ten compounds per day. Because the machine can be run continually, between 36,500 and 73,000 compounds may be purified annually. At five to ten compounds per day per a 5-day work week, it would take a chemist 20 to 40 years to do an equivalent amount of work.

Berger Instruments is demonstrating this new technology with assistance from Agouron Pharmaceuticals, AstraZeneca, the Delaware Economic Development Office, and the NICE³ Program sponsored by the U.S. Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- Pre-demonstration activities completed.
- Demonstration completed by September 1, 2001.
- Conduct ongoing commercialization activities and report on commercialization activities for 10 years.
- Submit final project report January 31, 2002.

NICE³ – National Industrial Competitiveness through Energy, Environment, and Economics:
An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry.
This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to $525,000. Grants fund up to 50% of total project cost for up to 3 years.

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